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Field Beans

IN

CANADA

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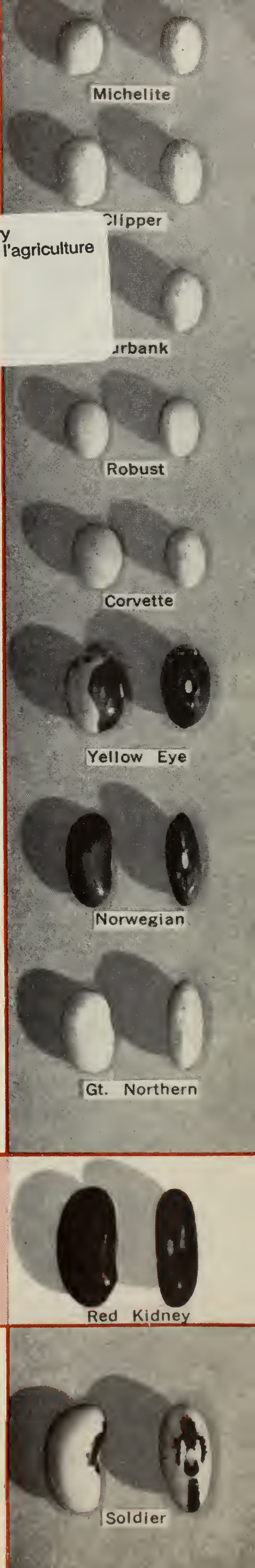

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FIELD BEANS IN CANADA

PRODUCTION, VARIETIES, MARKETING

By W. G. McGregor, Cereal Division
Experimental Farms Service

This bulletin deals with the bush or dwarf varieties of the genus Phaseolus which are the true beans. They are believed to be native to North America, and have been grown in Canada for many years. A great many varieties are horticultural and are harvested in an immature condition for food. Mature dry field beans are used for human food, also, and the injured or inferior beans frequently are fed to farm animals. The dry beans with which this bulletin deals are grown mostly for the production of the ripened seed.

Beans are legumes. To this family belong alfalfa, clovers, peas, vetches, soybeans, and a host of native wild plants. The characteristics of this family are the pea-like flowers, the pods, the compound leaves, and the nodules on the roots by which the growing plant is capable of taking up, indirectly, the free nitrogen of the air and storing it in the roots as an available form of plant food for future crops. Beans are an important crop from other considerations. In nutritive value they resemble closely the foods of animal origin, containing a higher percentage of protein than wheat, oats, or even meat. They are also a very good source of calcium. Where beans may be grown profitably and at a low cost per bushel, they are a high yielding and satisfactory cash crop. The bean crop can be handled at times when other crops do not demand attention so urgently.

Beans are not grown universally throughout the country as a commercial crop; in many areas production is limited to the home garden. At the present time garden beans are grown in all provinces. The average annual production of field beans in Canada for the years 1945 to 1949, inclusive, was 1,534,450 bushels. The average yield is approximately 17 bushels per acre. Commercial production is confined to the more favourable areas. Approximately 75 per cent of the total crop is grown in Ontario, mainly in the counties of Kent, Middlesex, and Huron of southern Ontario. In these counties beans are the most important cash crop.

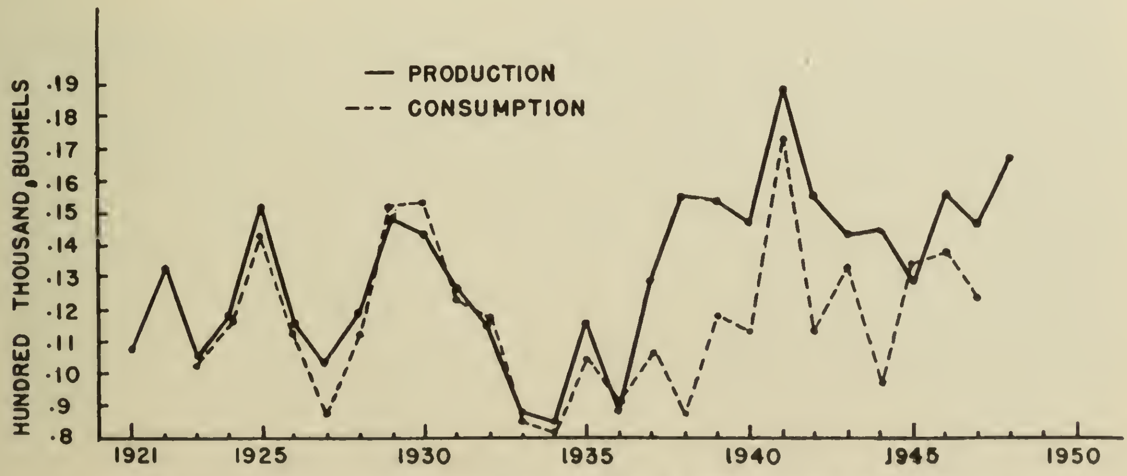

Fig. 1—Production and consumption of Field Beans in Canada, 1921-1948.

Field beans marketed as dry beans are used almost entirely for human food. Cull beans, when available, are valuable as concentrates in livestock feeding. The annual consumption in Canada has approached 1½ million bushels or seven to eight pounds per capita. Canadian consumption is low in comparison with that of the United States. There the average person consumes nine pounds per year, while persons of Mexican origin consume 50 pounds per capita. Exports for the period 1944 to 1948, inclusive, averaged approximately 200,000 bushels per year. The greater portion of this trade has been with the United Kingdom. Statistics indicate that Canada imports an average of over 40,000 bushels annually. This includes dried lima beans, which are not grown in this country. Since early in the 1930's production usually has exceeded consumption by a substantial margin and, therefore, during the period exports have greatly exceeded imports. Figure 1 illustrates the increase in production over domestic consumption in recent years.

The greatest single outlet for the bean crop is the canning industry, for the production of the well known pork-and-bean combination and for soup making. Recently the output of these products approached 6 million dozen cans. A portion of these are exported.

Varieties

Bean varieties are of many types. They vary greatly in size, shape, and colour, and may be mottled in different ways. Varieties used for the dry bean trade differ from those grown for horticultural purposes. The small white pea bean, sometimes called the navy bean, is preferred for the dry bean canning trade and by the consumer for home cooking because it retains its shape after proper processing. Some Red Kidney beans are canned, and usually are grown only under contract. A number of miscellaneous varieties are popular in certain districts or areas. In the Maritimes Province, as in the adjacent New England States, the Yellow Eye bean is grown. This is a large marrowfat type with a characteristic mottled eye pattern. In Western Canada, Great Northern, a large white bean popular in Idaho and Montana is sometimes grown. In many home gardens, where frosts are likely to be a hazard, only those varieties that mature early should be considered.

Descriptions of the recommended varieties follow:—

Michelite C.A.N. 2098, is the most extensively grown variety for commercial purposes. This variety was selected at the Michigan Experiment Station from a cross of Robust × Early Prolific. It was released in 1937 and distributed in Canada and accepted for registration by the Canadian Seed Growers' Association in 1940. Michelite is slightly earlier in maturity than Robust. In growth habit it is a trailing vine, producing short, rather straight pods with a marginal curved spur. The seed is glossy milk white, small, rather round, and weighs 200 to 220 grams per thousand kernels. Michelite is resistant to mosaic and moderately susceptible to bacterial blight and rust.

Robust C.A.N. 2025 is an old variety still grown to some extent in western Ontario. F. A. Spragg of the Michigan Experiment Station selected this variety from commercial material. It was distributed in 1915 and has been accepted by the C.S.G.A. for registration. Robust is medium to late in maturity, and produces a long, much branched vine with rather short, slightly curved pods having a short curved marginal spur. The seeds are a duller greyish white than those of Michelite, somewhat round and small, and weigh 210 to 230 grams per thousand. Robust is resistant to mosaic, semi-resistant to anthracnose, and susceptible to rust and bacterial blight.

Burbank C.A.N. 2006 was received from Luther Burbank in 1924. It is accepted by the C.S.G.A. for registration. Burbank has been grown chiefly in southern Alberta and is preferred there because of earlier maturity. It has a vine habit of growth and short, slightly curved pods with a short, curved marginal spur. The seeds are white, small, almost round, and weigh 230 to 260 grams per thousand. Burbank appears susceptible to anthracnose, mosaic, and bacterial blight.

Grainer C.A.N. 2067, a selection by E. C. Gohn of Rainy River, Ont., has been very similar to Burbank both in appearance and performance.

Corvette C.A.N. 2090 was distributed by the Cereal Division, Central Experimental Farm, in 1943. Corvette is similar to Michelite as to maturity, has a vine type of growth, and produces pods of medium length. The seeds are white with rounded ends, larger than those of Michelite, and weigh 260 to 290 grams per thousand. Corvette is resistant to mosaic and moderately susceptible to blight, anthracnose, and rust. It has yielded well, and produces a bean of good baking quality.

Clipper C.A.N. 3404 was also distributed by the Cereal Division, Central Experimental Farm, in 1949. It was selected from the cross Burbank × Beauty. Clipper has an upright habit of growth and the vine and pods are of medium length. It matures a little earlier than Michelite or Corvette. The seeds are white with rounded ends and are slightly smaller than Corvette, weighing 240 to 260 grams per thousand. Clipper is resistant to mosaic, and moderately susceptible to anthracnose and bacterial blight.

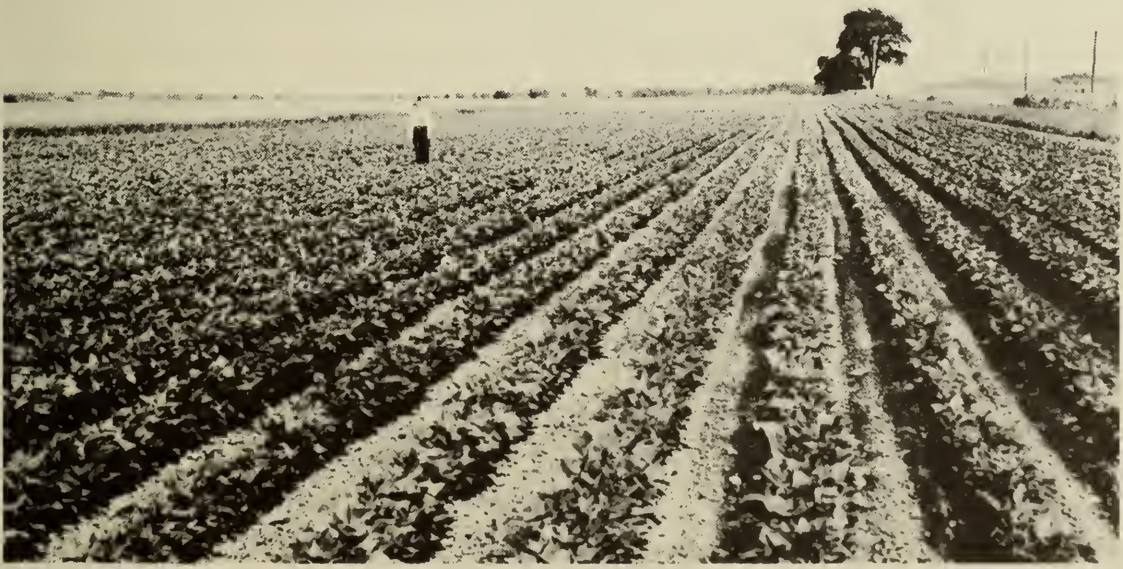

Fig. 2—A field of Clipper beans, Central Experimental Farm, Ottawa.

Norwegian C.A.N. 2027 was selected by the Cereal Division, Central Experimental Farm. It matures very early and is recommended for areas where early frosts are a hazard. This variety is strictly bush type in growth attaining a height of 10 to 15 inches and producing long, green, slightly curved pods with a rather long, curved marginal spur. The wings and standard of the flower are lilac, and the seeds are yellowish brown with a hilium ring of darker brown. The seeds are large, kidney shaped with rounded ends, and weigh 330 to 375 grams per thousand. Norwegian is resistant to mosaic and anthracnose, and semi-resistant to bacterial blight. The baking quality is very good. Professor Manley Champlin of the University of Saskatchewan has selected a white-seeded line from a crop of Norwegian which he called *Norwhite.* This selection is similar in other respects but has not been extensively tested.

Yellow Eye C.A.N. 2036 is a very old variety but it is still prized by some because of its good baking quality. Yellow Eye is medium to late in maturity, has a short vine type of growth, and pods of medium length. The seeds are large and rounded, weighing 425 to about 500 grams per thousand. They are white with a characteristic tawny yellow, wide, solid, eye-ring pattern covering about ¼ the area of the seed. In some improved strains the colour pattern is less extensive with considerable variation existing in the area covered. Yellow Eye, though resistant to anthracnose, is susceptible to mosaic and bacterial blight. The Experimental Station at Kentville, N.S., has selected an early strain of this variety and distributed it as *Kenearly* C.A.N. 3408. This selection matures about a week earlier than the ordinary Yellow Eye.

Great Northern: Several selections of this old variety have been grown in Canada for some time. The plants are trailing in habit of growth and produce large, somewhat curved pods with a marginal curved spur. The seeds are white, large, flat, somewhat kidney-shaped and weigh 340 to 380 grams per thousand. Different selections have varied in maturity. They have shown resistance to mosaic but susceptibility to anthracnose and blight.

Soldier C.A.N. 2049 is grown to some extent in the Maritime Provinces. This variety is a bush type and matures very early. The pods are long and green. The seed is large, kidney-shaped, and white with a reddish, irregular, mottled pattern around the eye. It is susceptible to anthracnose and blight.

Red Kidney: In Canada this variety can be matured in areas that produce Michelite. Many selections have been tested but these usually have been found quite susceptible to bacterial blight.

Varietal Adaptation

In general, beans require about the same climatic and soil conditions as corn. Beans are easily killed by frost. Because of this they can be grown successfully only in those sections that have a season long enough to permit planting after the last killing frost of spring and harvesting before the first killing autumn frost. Field beans can be grown on a great variety of soils ranging from sandy loams to clay loams. They thrive best on warm, porous soils that are at the same time fertile, retentive of moisture, and yet well drained.

The Maritimes: In the Maritime Provinces small areas of beans are grown on many farms for home use. Field beans are not reported statistically as a field crop in Nova Scotia or Prince Edward Island. In New Brunswick the production has been dropping steadily over the past decade, and is now insufficient to supply the home market. At the Experimental Station at Kentville N.S., a great many varieties have been tested. Navy, Michelite, and Kenearly

Yellow Eye are considered most suitable. Results obtained at the Experimental Station at Fredericton, N.B., indicate that the crop is well adapted to that area. Over an eight-year period Lapin, Burbank, and Navy have matured in an average of 109 days and yielded 35 to 39 bushels per acre. The earlier maturing varieties Soldier or Yellow Eye are recommended for districts with a shorter growing season although they have given somewhat lower yields.

Quebec: Small areas of beans for home use are grown throughout much of the province of Quebec and there are commercial crops in the vicinity of Montreal. In tests at the Experimental Station at Ste. Anne de la Pocatiere all varieties have matured. Navy, Burbank, Clipper, and Grainer have been about equal in productivity. Michelite has given a lower yield but the quality has been good. Varieties tested at the Experimental Station at Lennoxville, Quebec, have matured in a shorter period than those tested at Ste Anne de la Pocatiere. Corvette, Clipper, Navy, and Michelite have not differed significantly in yield.

Ontario: The small pea bean types are grown more extensively in western Ontario because they can be marketed widely throughout Canada and for the export trade. Michelite is the most popular variety in this area and has almost completely replaced Robust. Corvette, distributed in 1943, has yielded well but is not so easy to handle as Michelite. Clipper was introduced in 1948 and because of slightly earlier maturity than Robust and Michelite may be more useful in late planting or in areas where earlier maturity is essential to excape the frost. Small acreages of Red Kidney and Yellow Eye are grown sometimes for a special trade.

Prairie Provinces: The bean crop is limited almost entirely to the early maturing varieties. Field beans are not grown commercially in Manitoba or Saskatchewan. Tests conducted at different stations indicate that in most areas the season is seldom long enough to mature Navy and later varieties successfully. Norwegian has produced fair yields. Data from the Morden Experimental Station have shown that the average season in southern Manitoba is adapted to the production of some of the early pea bean types.

The growing season over a large part of southern Alberta appears to be long enough to grow beans successfully under average seasonal conditions. Burbank, because of its early maturity, has been grown commercially in the irrigated area. The interest in field beans decreased during the war years because of high grain prices and the difficulty of securing labour. Beans can be grown to advantage on farms where sugar beets are produced since neither the seeding nor the harvesting periods conflict, and the same equipment for drilling and cultivating can be used for both crops. The bean crop has been grown on dry and irrigated land at the Experimental Station at Lethbridge, Alta. There is much less danger from early frost under dry land conditions than under irrigation as the crop ripens at least a week earlier. However, the yield may be much lower than where irrigation is practised. Strains of Great Northern selected for uniformity and early maturity have yielded well. Burbank, however, is recommended for this area as it produces a small white pea bean that is much in demand.

British Columbia: More beans are grown in British Columbia than in the Prairie Provinces. The Experimental Farm at Agassiz, B.C., has obtained good yields from the common varieties which matured in 105 to 110 days. At the Experimental Station at Saanichton on Vancouver Island all varieties have yielded satisfactorily. Great Northern selection C. 59 has outyielded Navy, Robust, and other varieties of the pea bean type.

Marketing

The usual practice is to market beans in the condition in which they come from the thresher, leaving the cleaning, grading, and picking to the elevator operator. At the elevator they are first run over a grader and then over mechanical pickers. If they are still not marketable, hand picking may be required. Market grades for the commercial crop are as follows:—

STANDARD MARKET GRADES OF FIELD BEANS*

Grade Name	Standard of Quality	Maximum limits of foreign material			Total including splits damage, other beans, etc.
		Stones, pebbles, shale, or other similar material	Other foreign material	Other beans not of same colour, size, or shape	
No. 1 Canada Eastern Pea Beans.	Well screened and picked, of good natural colour.	Free.	Practically free.	Practically free.	1½%
No. 2 Canada Eastern Pea Beans.	Well screened and picked, of good natural colour.	Practically free.	1/20 of 1%	1/20 of 1%	3%
No. 3 Canada Eastern Pea Beans.	Well screened, slightly off colour.	1/50 of 1%	1/10 of 1%	1/10 of 1%	5%
No. 4 Canada Eastern Pea Beans.	Off colour..................	1/10 of 1%	½ of 1%	½ of 1%	8½%

"Any beans which do not meet the requirements of any of the other established grades are graded on sample. Beans of any type other than Pea Beans may be graded according to the above definitions, and under the same grade names, except that the commonly accepted commercial name or description or variety of such beans shall form part of the grade name in place of the name 'Pea Beans' in the above grade names; provided, however, that the use of a variety name in certifying to a grade of beans shall not imply any guarantee of varietal purity.

In such grades of beans of a type or variety other than Pea Beans, in addition to the prescribed maximum limits of foreign material, admixtures of beans of other varieties that are similar to the variety being graded in colour, size and shape, shall be permitted up to five per cent (5%) in No. 1, ten per cent (10%) in No. 2, and twenty per cent (20%) in No. 3."

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* "Definitions of Statutory Grades of Eastern Canada". Established under Section 24, Subsection 1, Schedule 2, of the Canada Grain Act, 1930, amended 1939. Issued through the King's Printer in 1939 by the Department of Trade and Commerce.

CULTURAL PRACTICES

By A. J. MacLean, Field Husbandry Division,
Experimental Farms Service

Rotations: Field/beans should be grown in a rotation that includes hay or pasture since these crops tend to conserve soil organic matter. Legumes such as clovers and alfalfa are particularly desirable as they have the added advantage of obtaining much of their nitrogen from the air. Beans do best following sod, but they may be grown successfully after other crops if clover or grasses appear somewhere in the rotation.

When hay or pasture is included in the rotation it should seldom be necessary to plough down a *whole* crop as green manure. However, the second growth of clover or alfalfa may be ploughed down for this purpose, or, in some areas, red clover in the year of seeding. If the soil is low in organic matter, or when farmyard manure is not available, sweet clover may be used as a green-manure crop. Fall rye is a useful cover crop, particularly on sloping land. It aids in preventing soil erosion and is a source of soil organic matter as well.

Preparation of the soil: Fall ploughing is advisable, particularly on heavy soils or when a thick sod or heavy crop residues are to be turned under. Spring ploughing, however, is preferable under certain conditions. On lighter soils, good results may be obtained if the ploughing is done in the spring at least a month before planting time. If such cover crops as sweet clover or fall rye are grown, they should be ploughed under in the spring when the crop is about 12 inches high, preferably a few weeks previous to planting the beans. In other instances, as on sloping land where the control of soil erosion is important, it may be advisable to plough in the spring.

The land should receive frequent cultivation to bring it to the best condition of tilth and to destroy weeds. A suitable seed-bed is fine and mellow at the surface but fairly firm underneath.

Manure and Fertilizers: Light sandy soils and those low in organic matter will benefit from an application of eight to ten tons per acre of well rotted manure. The manure may be applied in the fall or after the land is ploughed in the spring, and whether ploughed or disked in, it should be thoroughly incorporated with the soil. On soils well supplied with organic matter, manure may tend to produce vines rather than bean-bearing pods.

As a general rule, beans do not show the response to commercial fertilizer that is obtained with such crops as potatoes, clover, alfalfa, and grain crops. For this reason, it may be more profitable to use fertilizer on other crops in the rotation, and to endeavour to maintain the soil in a satisfactory state of fertility so that little or no fertilizer will be needed for the bean crop. When fertilizer is required, only relatively low rates should be applied. Phosphoric acid and potash are used—200 pounds per acre of superphosphate (20 per cent P_2O_5) should be satisfactory. On lighter soils, 200 to 300 pounds per acre of a fertilizer mixture containing some nitrogen, such as 2-16-6 or 3-18-9, according to conditions, may be applied.

A common method of applying commercial fertilizer for beans is with a combined grain and fertilizer drill. However, commercial fertilizer applied in direct contact with the seed may result in lower germination. To avoid this the fertilizer may be drilled in, or broadcast, previous to seeding the beans. If equipment is available the best method is to apply the fertilizer in bands one or two inches to the side of, and slightly below the level of, the seed.

Planting: Beans should be planted as soon as the soil warms up after the colder weather is past. About the first of June may be a suitable time, but this will depend on the nature of the soil, the place of the beans in the rotation, the variety used, and the season. It is important that the beans germinate quickly and make rapid, continuous growth. Wet, cool weather may delay germination. This may cause the beans to decay; and in addition an increase in maggot injury to the seedlings, and poor stands may result.

The rate of planting varies with the size of the bean. Planting white pea beans in 28-inch rows at a rate of approximately 5 seeds per foot requires 40 pounds of seed per acre. This is generally considered the optimum planting rate for this type. The marrowfat types, under similar conditions, require 60 pounds or more per acre.

The ordinary grain seeder with 7-inch spaces between the tubes is satisfactory for planting beans. If all but every fourth tube are plugged, the seeder will plant rows 28 inches apart, which is about the proper distance. Special bean planters are available also. The depth of planting will depend upon the kind of soil, the soil heat capacity and its moisture content. Seeding not more than one inch deep on clay loams and slightly deeper on sandy loams is satisfactory. To ensure quick, even germination it is essential that the seed be planted in a fine moist soil just deeply enough to be covered well.

Seed: Care should be taken in selecting beans for seed. It is advisable to select the plants from which seed is to be collected just before harvest. In this way high-yielding plants that ripen uniformly can be secured and plants showing symptoms of disease discarded. Pureness of variety is the first essential. It is important, also, to secure well developed, well matured, uniform, sound seed of strong vitality. Diseased seed will produce diseased plants, and infection may be spread throughout the crop.

The seed should be graded and tested carefully for germination before it is sown. The germination test can be made at home by planting a uniform sample of seed in a pot of moistened soil placed in a bright, warm location. Beans have shown little response to inoculation of the seed with nitrogen-fixing bacteria. However, experiments have shown that seed of low viability (hence susceptible to disease attack) may be treated with fungicidal dusts to control diseases, with consequent improvement in emergence and yield.

Cultivation: Much of the cultivation work on a bean field should be done before the seed is planted. This is best accomplished by providing a clean seedbed. Before the plants appear a light spike-tooth harrow or weeder may be run over the land. If this has not been done and the beans come up quickly, cultivation close to the bean row should begin at once. The ordinary corn or beet cultivator may be used for this work. Many of the roots of beans lie near the soil surface and will be damaged by deep cultivation. Hence the crop should be cultivated only deeply enough and frequently enough to keep the weeds under control. Careful cultivation should be practised early in the season so that little work need be done after the blossoming period begins. Most growers do not cultivate while the leaves are wet with dew or rain as there is then danger of spreading diseases.

Harvesting: Field beans should be harvested when most of the pods are yellow and beginning to dry out but before the seeds begin to shatter out of the pods. Fields do not always ripen uniformly, and sometimes this is true of individual plants also. Experiments now being conducted indicate that leaf defoliants may be used to hasten maturity, but further experiments are necessary to determine the type of defoliant to use and the rate and method of application.

In small fields or gardens beans are almost invariably harvested by hand. On larger acreages they may be pulled with a two-bladed puller or cutter that pulls the plants or cuts them off slightly below the surface of the soil. Two rows are pulled at once, and may be worked into one windrow, and then forked into small bunches for curing. More commonly a side-delivery rake is used to rake the beans into large windrows that can be handled more conveniently.

If beans are left exposed to the weather, and especially if they are rained upon, the quality may deteriorate. Moisture may not injure them materially, but extra labour will be required in spreading the beans to dry and in repiling them. If they are not threshed with the combine, beans should be stored in sheds or stacked as soon as they are cured.

Threshing: Small lots of beans may be threshed with a flail on the threshing floor. Common grain threshers may damage too many of the beans to be satisfactory. However, for threshing beans, these machines may be adjusted by removing a number of concave and cylinder teeth and reducing the speed of the cylinder. The combine is impractical for threshing standing beans, but it is often used to thresh beans from the windrow. It saves labour if the weather is favourable and the windrows are free from stones. Experience has shown that in threshing any bean crop care must be taken to avoid mechanical injury to the beans. In this connection cylinder speed and moisture content are very important.

Moisture content may vary throughout the day and the season, and it is an important guide in determining what the cylinder speed should be. When daily variations in moisture content range from damp in the morning to very dry in the afternoon the cylinder speed should be regulated accordingly. In the early morning it should be fast enough to open the damp pods and in the afternoon slow enough to avoid splitting or damaging the seed. The characteristics of the variety to be threshed should be known, also, as some varieties appear to be damaged more easily than others. More damage may occur with light feeding than with ordinary or heavy feeding.

When the beans are threshed and delivered to the warehouse they are cleaned and graded in machines of various types and then put over mechanical pickers before final bagging and storing. In handling beans constant care should be exercised to avoid all impacts that might damage the seed. Broken or split beans cannot be sold either for seed or commercial purposes.

DISEASES

By V. R. Wallen, Division of Botany and Plant Pathology,
Science Service

Field beans grown in Canada are subject to numerous diseases that take an annual toll by reducing yields of marketable seed. Some of the more important diseases are discussed in this section and control measures are given wherever possible.

Anthracnose

Bean anthracnose caused by a fungus, (*Colletotrichum lindemuthianum* (Sacc. and Magn.) Brioso and Cav.), is one of the most important diseases to growers of field beans in Canada.

The symptoms of the disease appear on the seed as dark, sunken lesions of varying size that may penetrate the seed coat and invade the cotyledons. When infected seed is planted the fungus present in these lesions produces spores that may be carried by wind and rain to infect the young leaves and stem. From the lesions that develop on the young leaves and stems infection spreads to the older leaves and pods.

Stem lesions first appear as orange to rust-coloured spots that enlarge lengthwise along the stem. The lesions gradually enlarge, become sunken, and produce great masses of spores that give the sunken part of the lesion a brick-red appearance. The border of the lesion appears brown to purple. When numerous lesions develop as a result of favourable weather conditions the stem is weakened and the plant falls over.

Infection of the leaves and petioles usually follows the veins and appears as a dark red-brown discoloration that later turns dark brown to black on the underside of the leaf.

Infected pods are the most conspicuous indication of this disease. The symptoms start as small flesh to rust-coloured spots that later enlarge and become circular and sunken. The lesions may be one-quarter of an inch in diameter when mature and are characterized by a purple border while the sunken part of the lesion appears pink due to the mass of spores. Under favourable conditions the lesions may develop and extend through the walls of the pod into the seed where the disease organism may live until the seed is sown. The new crop may become diseased as a result of using this infected seed.

Clean seed grown in semi-arid regions of the west, together with a crop rotation of three years may be employed as preventive measures for this disease. It is advisable not to enter bean fields during wet weather as infection may be spread by pickers, cultivation implements, or machines.

Bacterial Blight

Bacterial blight of beans is caused by two distinct bacteria *Xanthomonas phaseoli* (E. F. Sm.) Dowson, the cause of common blight, and *Pseudomonas phaseolicola* (Burk.) Dowson, the cause of halo blight. Symptoms of halo and common blight are very much alike.

The first symptoms of both diseases that are evident on young seedlings are small water-soaked spots on the leaf that enlarge and coalesce. As the halo blight type of lesion develops on the leaves it produces a zone of greenish-yellow tissue outside the water-soaked area. The common blight organism produces large brown areas that eventually cause defoliation of the plant. Additional leaf symptoms may develop in the small veins, spread to the large veins and finally to the midrib of the plant. Severe infection causes a reddening of the veins and gives a water-soaked appearance to the adjacent tissues.

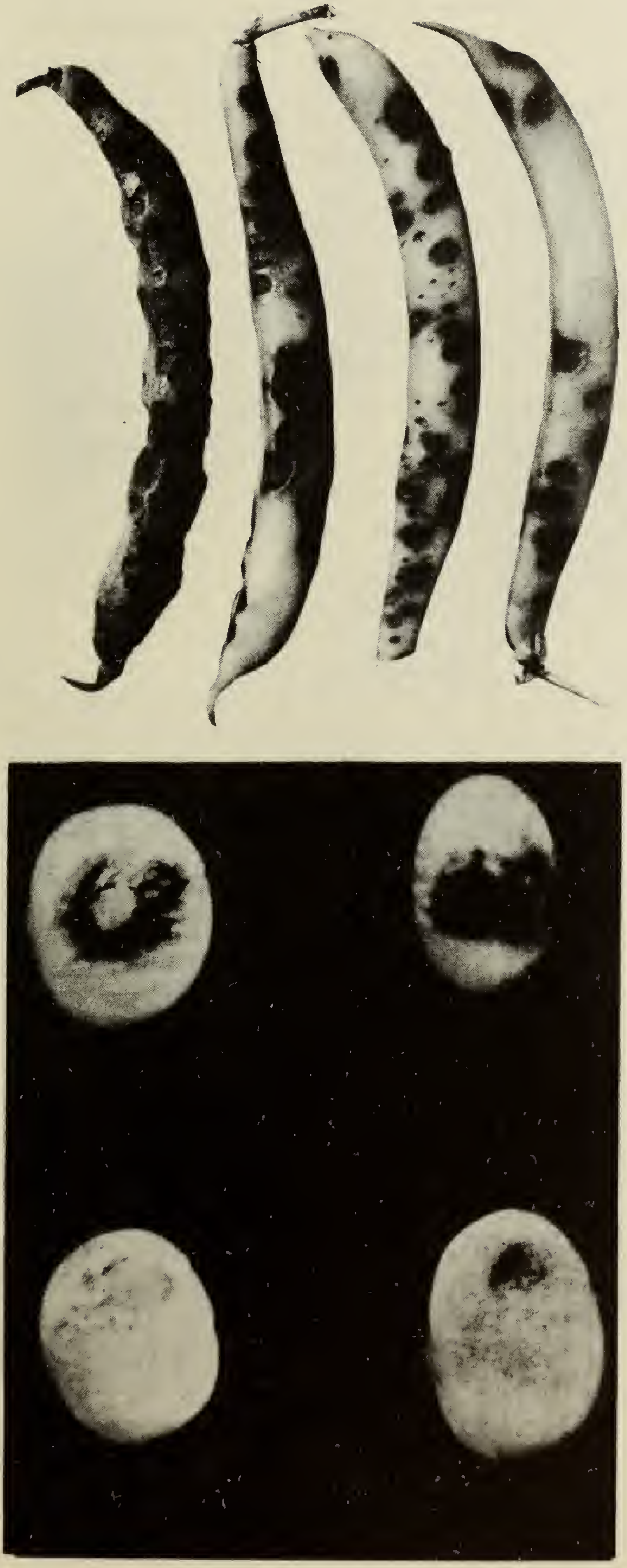

Fig. 3.—Bean anthracnose on pods and seeds. Note deep sunken lesions on the pods.

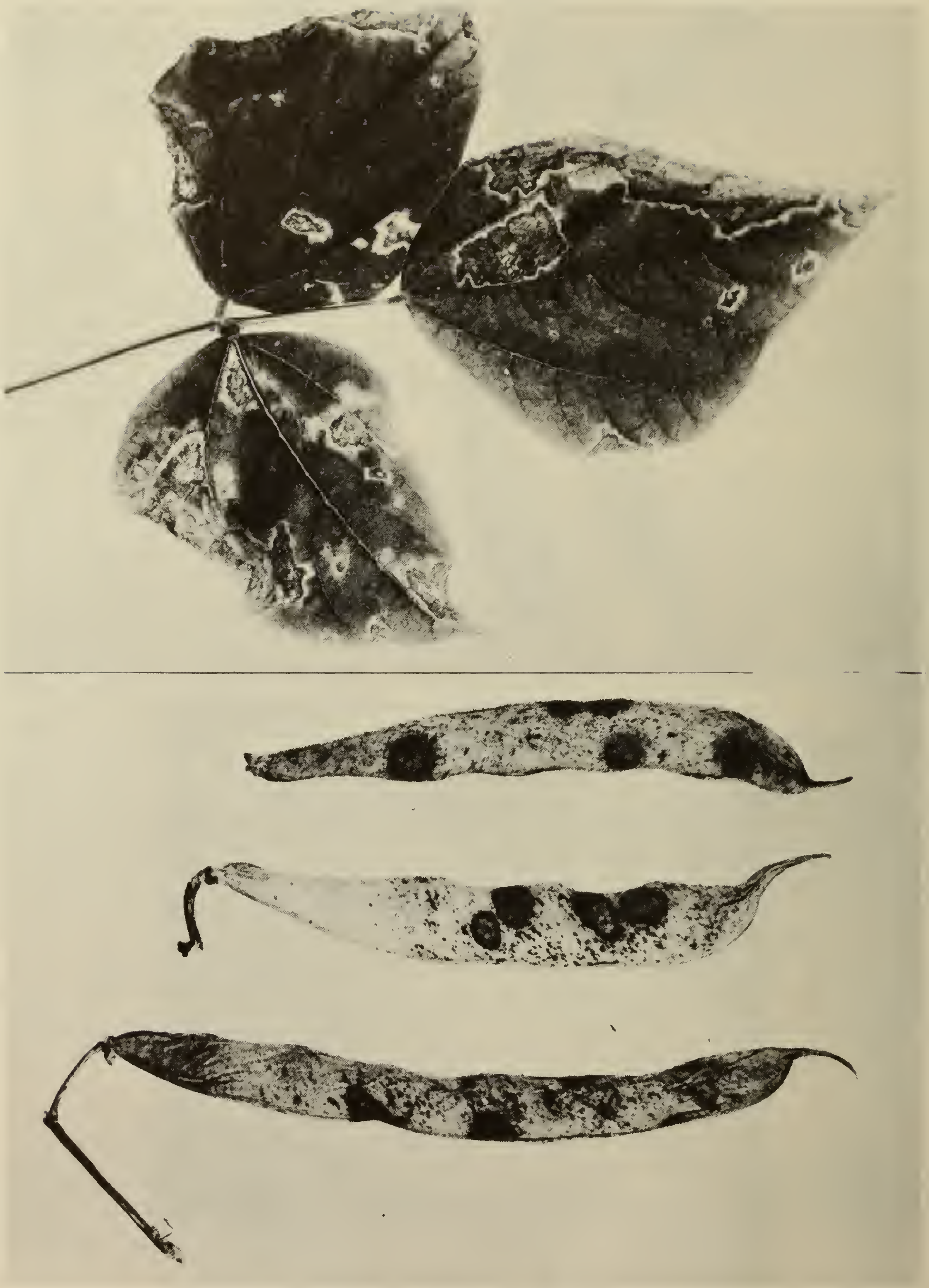

Fig. 4—Bacterial blight on pods and leaves. Note bacterial exudate present in the centre of the irregular water-soaked areas on the pods.

The symptons of the two diseases which may appear on stems, pods, and seeds are so much alike that it is impossible to distinguish them except where there is a bacterial exudate present on the lesions. In humid weather this exudate appears as a slimy yellow-coloured droplet on common blight lesions and in the case of halo blight as a cream or silvery-coloured droplet.

Stem lesions start as water-soaked spots that gradually enlarge and become sunken. Later they appear as reddish streaks extending up and down the stem. An amber-coloured lesion may develop on the stem at the base of the first true leaves. This lesion may weaken the stem and cause the plant to fall over.

The characteristic symptom on the pods is the appearance of small water-soaked spots that enlarge and become surrounded by a reddish-brown border. In humid weather a mass of bacterial exudate may appear on the lesion. The bacteria may infect the upper and lower suture of the pod and cause a discoloration of the adjacent tissue. It is through the suture that the bacteria invade the seeds, giving some of the seeds a varnished appearance and causing others to rot completely.

As this disease is also seed-borne, the use of clean seed is essential. Such seed may be obtained from the semi-arid regions of the west. At present there are no varieties of field beans resistant to both halo and common blight. As in the case of anthracnose it is not advisable to enter bean fields during wet weather.

Mosaic

Bean mosaic is a virus disease that is fairly widespread throughout Canada. Mosaic may cause extensive damage, but it rarely kills the plant.

There are two important bean mosaics in Canada, the common mosaic (bean virus 1) and yellow mosaic (bean virus 2). These mosaics produce many symptoms such as stunting of the whole plant, and mottling, malformation and puckering of the leaves. Infected leaves may be longer and narrower than normal leaves and may also show irregular light yellow and green areas. Young bean plants infected early in the season appear yellow and dwarfed, and may fail to produce a crop. Plants infected late in the season may produce a normal crop.

For the control of common mosaic the use of resistant varieties such as Robust, Michelite, and Great Northern C 59 is advisable. There is no adequate control for yellow mosaic. Sweet clover appears to be the principal host for this virus, therefore beans should be planted in regions remote from this host.

Rust

Bean rust (caused by *Uromyces appendiculatus* (Pers.) Fr.) is another fungus disease. It is not considered one of the more serious diseases in Canada, but under certain conditions may cause considerable damage.

Bean rust may attack the pods and leaves but rarely the stem. The disease first appears as small white raised pustules that gradually turn reddish-brown with the production of spores. There is often a secondary ring of yellowed tissue surrounding the pustules.

In the United States, dusting with sulphur at frequent intervals when the plants are young has given good control of this disease. As soon as the primary leaves have unfolded, sprays or dusts should be applied at weekly intervals until flowering begins. It is dangerous to use sulphur after the flowers have opened as this will prevent pod formation. Seed treatments are of no value as this disease is not seed-borne.

Sunscald

Sunscald is caused by intensive light following high humidity and may affect the stems, pods, and leaves. Bean plants nearing maturity are more likely to be affected than younger plants. Sunscald appears first as small brown areas on the leaf that later expand and form large islands of dead tissue. On the pods, sunscald first begins as tiny reddish-brown spots that enlarge and form streaks. These streaks may coalesce and cover almost the entire surface of the pod exposed to the sun.

Sunscald lesions on the leaves and pods may be mistaken for bacterial blight. However, this type of injury does not become so dark or sunken as the lesions of bacterial blight. The absence of a bacterial exudate also serves to distinguish the two lesions.

There is no control for sunscald.

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